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REVIEW ARTICLE

Stevia : The Herbal Sugar of 21st Century

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ABSTRACT

Stevia is the new emerging alternative source of calorie free sweetener having no carbohydrate and fat. It is 20 to 30 times sweet than cane and beet sugar, highly nutritious, delicious, non-toxic and non-additive sugar. It also enhances the flavour, helpful in digestion, weight reduction, anti oxidant, prevent dental caries and having antimicrobial and anti-plaque properties, increases mental alertness, increase energy levels but does not affect the blood sugar level, therefore key-source sweetener for diabetic world. Besides, *Stevia* can be used in hypertension, hypoglycemic, helpful in skin toning and healing, tobacco and alcohol cravings and a tonic for pancreas. It can also be used as alternative source of sugar for food confectioneries, bakeries, fruit juices, jams, biscuits, chocolates, vegetables and other food stuffs. The recent researches alongwith future prospective of this new emerging medicinal plant has been discussed in this chapter.

Keywords : Stevia, sugar, cultivation, uses

INTRODUCTION

Stevia is a native plant of Paraguay (South America). It is indigenous to the Rio Monday Valley of the Amambay Moutain Region where it grows as a perennial at an altitude between 200-500 metres having a mean temperature of 23 °C (range -6 °C + 43 °C) and rainfall ranging from 1500-1800 mm per annum. The native Guarani tribe had known for centuries the unique sweetening power of its leaves and other medicinal properties. They called the plant "kaa he-he" which translates as "sweet herb" and used it as sweetener for their green herbal tea "mate" and other domestic purposes as a flavour enhancer. In due course, it was introduced to settler. By now, Stevia is being consumed in Japan, Brazil, USA, Argentina, China, Canada, Paraguay and Indonesia.

Characteristics

Stevia rebaudiana a member of the Compositate/ Asteraceae family and as such is related to sunflower, marigolds and chrysanthemums. Stevia has an alternate leaf arrangement and herbacious growth habit (Fig. 1a) with flowers arranged in indeterminate heads (Plate 1g). The flowers are small and white with a pale purple throat. The pollen can be highly allergic.

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Source of Sweetness

Stevia derives its sweetness from diterpene glycosides – eight in number (steviol glycosides). These are synthesized, at least in the initial stages, using such the same pathway as gibberellic acid, an important plant hormone. The four major steviol glycosides are:

- stevioside
- rebaudioside A
- rebaudioside C
- dulside A

Propagation

In the wild, Stevia regenerates from seed, from the rooting of plant stems touching the ground (Plate 1c) and from regeneration at the base of the plant (crown division). Seed germination is notably very poor, commonly due to infertile seed. Some plant varieties/selections produce virtually no viable seed due to their self-incompatibility.

Under cultivation, Stevia can be propagated by seed, by tissue culture and by vegetative cutting (and plant separation) (Plate 1c). Since germination rates are poor and seedlings are very slow to establish, it is best grown as an annual or perennial transplanted crop. Clonal propagation is practical

for small scale production, but is probably not economically viable for large scale Stevia production in those regions where labour costs are high.

Cultural Practices

A planting density ranging from 40,000 plants/acre have been found suitable for maximum production and is recommended by our centers. Leaf yield increased with increasing density up to 83,000 and 1,11,000 plants per ha for the first year of production (Plate 1d). In Canada, a plant population of 1,00,000 per hectare is recommended. Densities of 80-100,000 plants per hectare on row spacing of 45-65cm are generally recommended.

The concentration of glycoside in the leaves of Stevia increases when the plants are grown under long days. Since glycoside synthesis is reduced at or just before flowering, delaying flowering with long days allows more time for glycoside accumulation.

On the whole plant level, steviol glycosides tend to accumulate in tissues as they age, so that older lower leaves have more sweetener that younger upper leaves, Since chloroplasts are important in precursor synthesis, those tissues devoid of chlorolphyll, like roots and lower stems contain no or trace amounts of glycosides. Once flowering is initiated glycoside concentrations in the leaves become low. Therefore, harvesting is to be done just prior to flowering when steviol glycoside content in the leaves is at its maximum.

Nutrition and Fertilization

Stevia plants do best in red soil, alluvial soil or sandy loam with a pH range of 5-7.5. Since the feeder roots tend to do be quite near the surface, it is a good idea to add compost for extra nutrients if the soil is sandy. Besides being sensitive to cold during their developmental stage, the roots can also be adversely affected by excessive levels of moisture. So care should be taken not to over water them and to make sure the soil in which they are planted drains easily (Plate 1e). Most organic fertilizers would work well, since they release nitrogen slowly.

Scientists of AKS Herbal Research and Land Development Centre has worked out that humic, fulvic and humate contents are more important in comparison to inorganic fertilizers containing N, P, K alone or in combinations as per general recommendation. Stevia cultivation requires 120 Kg of humic contents and 20 Kg of fulvic contents per acre basis. These contents are in any existing fertilizer, so far available in India. Keeping this in view, our scientists formulated a unique pure organic fertilizer containing approx. 12% humic acid and 2% fulvic components, named AKS BIOCROP, which is under process of patent registration. The AKS BIOCROP has been recommended at fertilizer dose of 100 liters per acre of Stevia cultivation in alluvial soils to fulfill its nutritional and fertilizer requirement.

Since Stevia is very slow to establish and does not compete well with weeds, it would be essential to de-weed the plot prior to planting and control weed growth thereafter to produce ample yield and a clean crop.

Stevia is known to be free from pest attacks, its inherent sweetness in fact acting as an insect repellant. Therefore, insecticides are not required at an essentially basis as in other crops. This also helps in getting organic *Stevia*. Two fungal diseases, *Septoria steviae* (leaf spot) and *Sclerotinia sclerotoirum*, have been reported in Canada. Neem based pesticides could be used as a precautionary measure. Recently, scientists of our center have developed a pure botanical pesticide, named AKS BIOCARE, which has been found, as more suitable for IPM of Stevia cultivation. AKS Research center has recommended 2 lit/acre of AKS BIOCARE for better cultivation of disease/pest free Stevia.

Harvesting

As stated above, harvesting must be commenced before flowering begins. Stevia can grow upto a height ranging from 60-75 cms (Plate 1f). Heights upto one meter have also been recorded. When the time does come to harvest, the easiest technique is to cut the branches off with pruning shears before stripping the leaves.

In warmer climates of India, we can harvest Stevia leaves 4 to 5 times a year with the first harvesting at 90 days of the crop.The parent crops can be maintained with good yields up to 5 years . In Paraguay/Brazil, three harvests a year are normal. In mid –summer harvest intervals can be less than two months. In Indonesia up to seven harvests have been possible per year.

In winter days only one harvest per planting is possible, which will reduce the total yield . Our research center has evolved a new technique for better production of Stevia yield in winters by applying polythene + hasien cloths during night when temperature goes down to below 5 °C. Again by covering the harvested crowns of the plants (with polythene + hasien cloth etc.), plants can survive over winter and production for a second season can also be possible.

Crop Yields

Experimental yields suggest that systems with multiple harvests a year will give higher yields and, where ratoon crops are grown, harvests in the second and third years are likely to be higher than for crops requiring replanting each year.

Yields would decline after three years needing replacement of plant material. However, our research center is confident that with good management practices, yields can be stretched upto five years and more.

Post Harvest Operations

Once all the leaves have been harvested, they have to be

dried. This can be accomplished on a screen or net. The drying process is not one that requires excessive heat, more important is good air circulation. If sun dried, it would take 6-8 hours depending on the temperature. Longer drying times will lower the stevioside content of the final product. A green dried leaf colour is desirable and represents good quality. Crushing the dried leaves is the final step in releasing stevia's sweetening power. This can be done either by hand or for greater effect, in a coffee grinder or in a special blender for herbs.

AKS R&D Centre has developed a new technique for the drying and harvesting of Stevia leaves, by applying weather-turf using electric motor giving a uniform heating effect harvested leaves spread on a wire-mesh. This way we can save time and labour in comparison to sun drying and quality would also be improved.

Stems of Stevia plants contain little or no sweeteners, although it is suggested that they may contain some flavour enhancers, odourisers and other agents of potential use for improving food-stuffs or alcoholic beverages.

Forms of Stevia Usage

Stevia can be used in many forms. The choice depends upon the amout of sweetness required (white extract powders are the sweetest).

(a) Fresh Stevia Leaves

This form of Stevia is the herb in its most natural, unrefined state. A leaf picked from a Stevia plant and chewed will impart an extremely sweet taste sensation reminiscent of licorice that lasts for quite a while. To have a more practical application as a tea or sweetener, the leaves must be dried or put through an extraction process, which makes the sweet taste even more potent.

(b) Dried Leaves

For more of the flavour and sweet constituents of the Stevia leaf to be released, drying and crushing is necessary. A dried leaf is considerably sweeter than a fresh one, and is the form of Stevia used in brewing herbal tea. Dried Stevia leaf may come in bulk or packaged like tea bags. It can also be finely powdered. In this form, it is 15-20 times sweeter than sugar (one teaspoon of Stevia is approximately equivalent to one cup of sugar). It has a greenish colour and can be used in a wide variety of foods and beverages, including coffee, sweets, confectionaries and several edible dishes. It can also be used to make an herbal tea blend. Its distinctive flavour is reminiscent of licorice, which will blend very well with different aromatic spices, such as cinnamom and ginger. AKS Research center has planned to release the Stevia powder in market in suitable packing.

(c) Stevia Extracts

The form in which Stevia is primarily used as a sweetener in Japan is that of a white powdered extract. In this form it is approximately 200 to 300 times sweeter than sugar (by weight). This white powder is an extract of the sweet glycosides (natural sweetening agents) in the Stevia leaf.

Not all Stevia extract powders are the same. The taste, sweetness and cost of the various white Stevia powders will likely depend on their degree of refinement and the quality of the Stevia plant used. AKS have also been planning to isolate the active compound of sweet glycosides in purest form for different commercial and medicinal uses.

(d) Liquid Concentrates

These come in several forms. These are a syrupy black liquid (that results from boiling the leaves in water), which can enhance the flavour of many foods. Steeping Stevia leaves in distilled water or a mix of water and grain alcohol makes another type. A liquid can also be made from the white and preserved mixed with water, and preserved with grapefruit seed extract. Our scientists worked that Stevia liquid concentrate can be used as a best source for filler of Ayurvedic medicinal syrups, which were previously prepared with jaggery source as filler.

USES OF STEVIA

Stevia as a Flavour Enhancer

Traditionally, Stevia has been used as a flavour enhancer in addition to its use in herbal tea as sweetening agent. A good quality leaf is estimated to be 30 times sweeter than cane sugar or sucrose. The active constituents of stevia are considered by the world's leading food scientists as the "sweeteners of the future."

Therefore, every new development in the area of Stevia research is anxiously awaited and thoroughly analyzed when it appears. Countries in which the currently used artificial sweeteners are on the brink of being banned are desperately trying to find new, sage, non-caloric sweeteners. AKS Herbal Research and Development Centre has planned to launched the world largest project of 'Organic Cultivation of Stevia' with the support of Union Bank of India in India. And in other countries, firms that hold exclusive rights to currently used sweeteners are extremely fearful of the advent of new, sager sweeteners, over which they will have no control. The emergence of a totally natural, non-patentable sweetener would undoubtedly spell the death knell check the manufacturers of artificial sweeteners like aspartame and saccharin.

In India by 2020 it is estimated that more than 40% population will be affected by diabetic health problems. Existing artificial sweeteners are found harmful to fulfill the desire of diabetic consumers. Our scientists have suggested that Stevia sugar can serve as best alternate source of sugar for diabetic

patients in future by fulfilling their need of sweet taste and desire.

Use of the whole leaf is an easier way to obtain better taste than through efforts aimed at trying to improve the taste of certain specific constituents. Research is now started in many countries to improve the taste of individual steviosides or rebaudiosides. Since the white crystalline powder exhibits a quite persistent bitter and astringent aftertaste, its use as a commercial sweetener often backfires. Thus, most manufacturers who use the isolated constituents of stevia usually have to combine it with other kinds of typical sugars. Since, rebaudiosides taste better, methods are constantly being sought to synthetically convert steviosides to rebaudiosides. But even the rabaudiosides must be combined with other kinds of sugars to obtain necessary sweetness. Finally, in the ultimate irony, there are processes currently under development for improving the taste of stevioside by combining it in various ways with other substances obtained directly from Stevia.

Medicinal and Therapeutic Uses

Stevia users believe there are many very legitimate reasons for using Stevia as a medicinal food. In spite of the prominence Stevia has obtained as a flavour enhancer, it contains a variety of constituents besides the steviosides and rebaudiosides, including the nutrients specified above and a good deal of sterols, triterpenes, flavonoids, tannins, and an extremely rich volatile oil comprising rich proportions of aromatics, aldehyde, monoterpenes and sesquiterpenes. These and other as yet unidentified constituents, probably have some impact on human physiology and may help explain some of the reported therapeutic uses of Stevia.

(a) Hypoglycemic Action

It is believed that the presence of the steviosides themselves that has produced dozens of empirical and semi controlled reports of hypoglycemic action. Paraguayans say that stevia is helpful for hypoglycemia and diabetes because it nourishes the pancreas and thereby helps to restore normal pancreatic function. In semi-controlled clinical reports one also encounters this action. A 35.2 per cent fall in normal blood sugar levels after 6-8 hours was reported following the ingestion of a Stevia leaf extract. Other workers has reported similar trends in humans and experimental animals. These kind of results have led physicians in Paraguay to prescribe Stevia leaf tea in the treatment of diabetes; similarly, in Brazil, Stevia tea and Stevia capsules are officially approved for sale for the treatment of diabetes.

However, it is important to note that Stevia does not lower blood glucose levels in normal subjects. In one study, rats were fed crude extracts of Stevia leaves for 56 days at a rate of 0.5 to 1.0 gram extract per day. Another team of scientists replicated these procedures. Neither group observed a hypoglycemic action. The experimental research on the effects of stevia on blood sugar levels in human patients with diabetes and hypoglycemia is in progress in many countries.

The general feeling in the scientific community is that the mild acting nature of the plant and its total lack of toxic side effects obviate the need for extensive and expensive research programme.

(b) Cardiovascular Action

A good deal of experimental work has been done on the effects of Stevia and stevioside on cardiovascular functioning in man and animals. Some of this work was simply looking for possible toxicity, while some was investigating possible therapeutic action. In neither case have significant properties been found. There is almost always a slight lowering of arterial blood pressure at low and normal doses, changing to a slight rise in arterial pressure at very high doses. The long-term use of stevia would probably have a cardio tonic action, that is, it would produce a mild strengthening of the heart and vascular system.

(c) Antimicrobial Action

Stevia is known to possess the ability to inhibit the growth and reproduction of bacteria and other infectious organisms. This is important in at least two respects. First, it may help explain why users of stevia-enhanced products report a lower incidence of colds and cough, and second, it has fostered the invention of a number of mouthwash and toothpaste products. Research clearly shows that *Streptococcus mutants*, *Pseudomonas aeruginos*, *Proteus vulgaris* and other microbes do not thrive in the presence of the non-nutritive Stevia constituents. This fact, combined with the naturally sweet flavour of the herb, makes it a suitable ingredient for mouthwashes and for toothpastes. Stevia has even been shown to lower the incidence of dental caries. In India, toothpaste using *Stevia* and *Aloe vera* has been commercialized.

Digestive Tonic Action

In the literature of Brazil, stevia ranks high among the list of plants used for centuries by the "gauchos" of the southern plains to flavour the bitter medicinal preparations used by that nomadic culture. For example, it was widely used in their "mate" herbal tea. Through much experimentation, these people learned that Stevia made a significant contribution to improved digestion, and that it improved overall gastrointestinal function. Likewise, since its introduction in China, Stevia tea made in either hot or cold water, is used as a low calorie, sweet-tasting tea, as an appetite stimulant, as a digestive aid, as an aid to weight management, and even for staying young.

Effects on the Skin

One of the properties of a liquid extract of stevia that has not yet been investigated experimentally is its apparent ability to help clear up skin problems. The Guarani and other people who have become familiar with stevia report that it is effective when applied to acne, seborrhea, dermatitis, eczema, etc. when placed directly on cuts and wounds, more rapid healing, without scarring, is observed. This treatment may sting for a few seconds, but a significant lowering of pain follows this. Smoother skin, softer to the touch is claimed to result from the frequent application of stevia poultices and extracts.

Contraceptive Action

There is a small controversy surrounding Stevia that still receives attention from time to time in the popular press and even by many scientists. This is about Stevia impacting fertility. It seems that in 1968 a paper appeared that claimed that certain tribes of Indians in Paraguay (the Matto Grosso) used Stevia tea as a contraceptive with apparently very good results. In subsequent experimental work, utilizing on rats, these researchers found that the treatment was supposed good for periods of up to two months. Subsequent work has repeatedly failed to replicate the earlier study. Furthermore, at least one attempt to locate tribes in northeastern Paraguay that used stevia to control fertility failed to confirm the story.

On the contrary effect of Stevia on reproductive physiology that appears to be valid, but this needs further study before definite conclusions can be drawn, is a healing effect on the processes underlying prostate disease. Just how important this finding is must await further research.

Safety Concerns

One of the most obvious indications of the safety of Stevia is that there have never been any reports of ill effects in over 1500 years of continuous use by Paraguayans. A similar indication of safety is the observation that despite over 10 years of widespread use of stevioside as a sweetening agent in Japan, years in which literally scores of tons of stevioside were ingested, not a single report of side effects of any kind has been reported. This may be compared with the track record of aspartame, which is the number one source of consumer food complaints made to the FDA in the USA. Nevertheless, in spite of the record of safety several official laboratory tests have taken place.

The first official investigation of possible toxicity from Stevia was performed in 1930 by Pomaret and co-workers in South America. Their tests were negative. They observed that stevioside passes through the human alimentary canal without being altered by digestive processes. That is, it goes out in exactly the same form as during eating. The issue is important because some of the metabolites of stevioside, as opposed to the whole leaf, have been shown to be toxic and researchers have cautioned against the use of stevioside for human consumption until it is known for certain that stevioside is not metabolized in the human body. A typical statement from a report published in 1974 says:..."the long-term effects of ingestion of stevioside would have to be investigated carefully before it could be considered for human use as a sweetener in the United States ... It remains to be proved that stevioside does not split to form any steviol in the human digestive tract". This challenge is still unattended. Perhaps that is why the United States resists all efforts to seriously explore the possible use of stevia as a sweetener. No further progress on the issue has been made since 1974. It appears that Pomaret's observations still hold.More elaborate safety tests were performed by the Japanese during their evaluations of Stevia as a possible sweetening agent. Few substances have ever yielded such consistently negative results in toxicity trials as has Stevia. Almost every toxicity test imaginable has been performed on Stevia extract or stevioside at one time or another. The results are always negative. The only related effect ever observed was the inhibition cell respiration (oxidative phosphorylation) in certain isolated cell components, but never in whole cells. What this showed was a reduction in toxicity due to a substance known as atractylignin, a poison that attacks cells of the liver. This result suggests that stevia could be used as an antidote in rare cases of poisoning by that chemical. The overall result of this action of stevia, then, turns out to be positive.

Another example of a good toxicology trial was one performed in 1985 by Yamada and co-workers. They administered stevioside and rebaudioside A to rats for two years at the rate of 0.3 – 1 per cent of their diet. The animals were than sacrificed, and the researchers conducted biochemical, anatomic, pathological and carcinogenic tests on 41 organs following autopsy. In addition they performed ongoing haematological and urine tests on the same animals. Each of the animals was matched to a control animal that experienced exactly the same treatment except for the Stevia. In the end, the symptoms and alterations noted by the research staff did not vary at all between the groups, and no dose-response effects were noted, even at the highest dose (1 per cent), which is equivalent to 125 times the average daily dose of sweeteners that a normal human would require.

Similar series of tests carried out by the National Ministry of Health and Welfare in Japan also failed to find any form of toxicity whatsoever.

Specific Products/Purposes of Use

On the basis of its various qualities, Stevia has found its use for the following purposes:

- Table top sweetener – for tea, coffee etc.
- Soft drinks, fruit juices, ice creams, yoghurts.
- Cakes, biscuits, pastries, pies, baking.

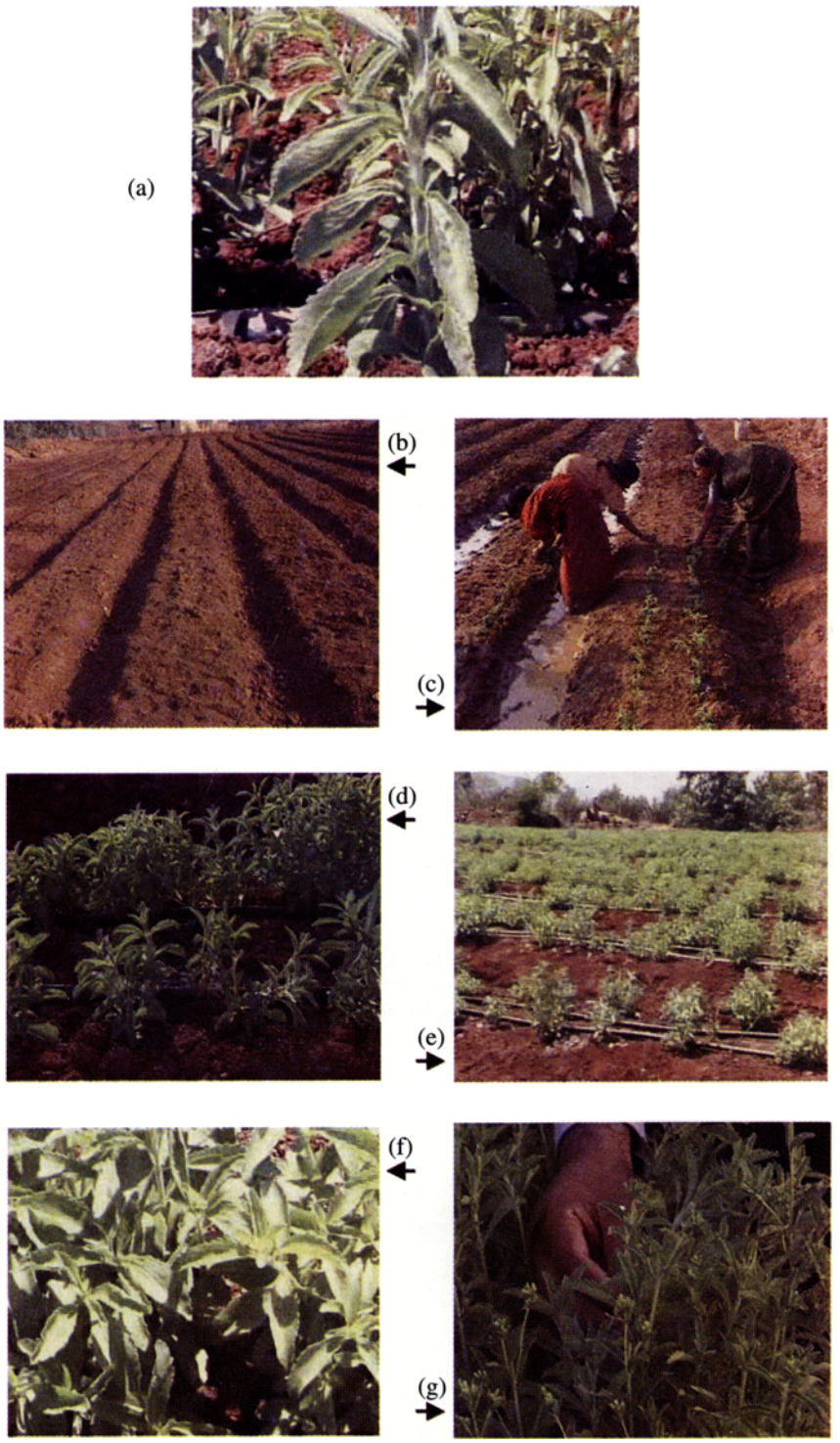

Plate 1 : (a) Morphology of *Stevia* plant, (b) Land and furrow preparation for *Stevia* planing, (c) Cultivation of *Stevia* shoot on ridges, (d) Young grown *Stevia* plants, (e) Network of irrigation in *Stevia* field, (f) Stevia leaves ready for harvesting, (g) Flowering stage of *Stevia*

Annexure- I

Economics of Stevia Cultivation (Only Organic Cultivation) on 1 Acre basis

(In Indian Rupees)

S. No.	Details	1st Year	2nd Year	3rd year
1.	Cost of Cleaning the Land Preparation of Land Labelling & Preparation of Beds.	2000	00.00	00.00
2.	Cost of Planting Material @ Rs 8/per plants 30,000 plants (including transportation cost of Rs. 5000/-)	2,45000.00	00.00	00.00
3.	Cost of Plantation	1000.00	00.00	00.00
4.	Cost of Organic Fertiliser "AKS BIOCROP" 100ltrs @ Rs 1250/ per ltr.	1,25000.00	1,25000.00	1,25000.00
5.	Cost of Irrigation (Including Electricity, Labour & Diesel Charges)	12000.00	10000.00	10000.00
6.	Plant Protection and Application	1000.00	1000.00	1000.00
7.	Hand Weeding	2000.00	2000.00	2000.00
8.	Gap Filling, Plant Cost & Plantation	-	25000.00	25000.00
9.	Harvesting Expanses	2500.00	2500.00	2500.00
10.	Plant Harvest Expanses	1000.00	1000.00	1000.00
11.	Contingencies	2000.00	2000.00	2000.00
12.	Transportation & Misc.	1500.00	1500.00	1500.00
	Total	**385000.00**	**170000.00**	**170000.00**
	Totat Cost of Organic Cultivation of Stevia on 1 Acre basis	**385000.00**	**170000.00**	**170000.00**

Income :

While agriculture is totally nature risk based activity, if all goes favourable the aspected yield should be calculated as

in 1st year	2nd year	3rd year
1800 Kg Leaves	2500 Kg Leaves	2500 Kg Leaves

Return :

It is also agricultural produce, there may be fluctuation in prices on basis of demand avaialbility & quality. But for financial Institutions (FI). it is a safe to consider that there is 50% subsidy by National Medicianl Plant Board (Govt. of India), which will be directly reimbursed to FIs.

Actual Financial Gain to Farmers :

In present scenario of Indian Agriculture Stevia Cultivation is supposed to be in list of higher income crops. After paying all the loans, interest and all others farming expanses, a farmer would earn Rs. 1 lac to Rs. 1.20 lac net gain in 1 acre on 3 years basis. On an average it appears Rs. 33 to 40,000 per acre/per year basis as net tax free income.

Moreover AKS GROUP is leader in India for the Organic Cultivation of quality Stevia, it will be a sincere efforts by all means that Stevia Cultivators will fetch more and more profit in coming days due to established market and global demand of Indian Stevia and their value added produces.

- Jams, sauces, pickles, jellies, desserts.
- Chewing gum, candies, confectioneries.
- Sea-foods, vegetables.
- Weight-watcher diets and Diabetic diets.
- Skin creams.
- Toothpaste, mouthwashes – plaque retardant/cavities prevention
- Hypertension treatment and blood pressure control.
- Alcoholic beverage enhancer (aging agent and catalyst).
- Tobacco additive and flavourant.

CONCLUSION

Stevia is the new emerging alternative source of calorie free sweetener having no carbohydrate and fat. It is 20 to 30 times more sweetener than cane and beet sugar, highly nutritious, delicious, non-toxic and non-additive sugar. It also enhances the flavour, helpful in digestion, weight reduction, anti oxidant, prevent dental caries and having antimicrobial and anti-plaque properties, increases mental alertness, increase energy levels but does not affect the blood sugar level, therefore key-source sweetener for diabetic world. Besides, *Stevia* can be used in hypertension, hypoglycemic, helpful in skin toning and healing, tobacco and alcohol cravings and a tonic for pancreas. It can also be used as alternative source of sugar for food confectioneries, bakeries, fruit juices, jams, biscuits, chocolates, vegetables and other food stuffs. The recent researches alongwith future prospective of this new emerging medicinal plant has been discussed in this chapter.

NABARD has included Stevia in the list of 40 Medicinal and Aromatic Plants whose financing by banks is eligible for refinance on a three-year basis vide its circular dated August 18, 2003.

Climate conditions of India favour Stevia cultivation in various parts of the country providing 3-5 harvests per annum. It can provide the following benefits:

- Primary producers – enabling greater diversification opportunity and returns per acre of investment.
- Rural sector – additional employment if a commercial extraction plant is established.
- The consumer – potentially reduced health risk than if consuming artificial sweetener.
- The economy – through import substitution of current imports of artificial sweeteners.

AKS Herbal Research and Land Development Center has already approached to National Medicinal Plant Board, New Delhi to provide subsidy to farmers who will take initiative in cultivation of *Stevia* in India. AKS Herbal Research and Land Development Center has also proposed a project in 1000 acres for organic cultivation of Stevia in India and worked out the economy and budget for organic cultivation Stevia under Indian conditions (Annexure I).